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(58) Field of search
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(71) Applicant
Gottfried Hagen AG
Rolslover Strasse
95-101
5000 Köln 91
West Germany

(72) Inventor
Lutz Horn

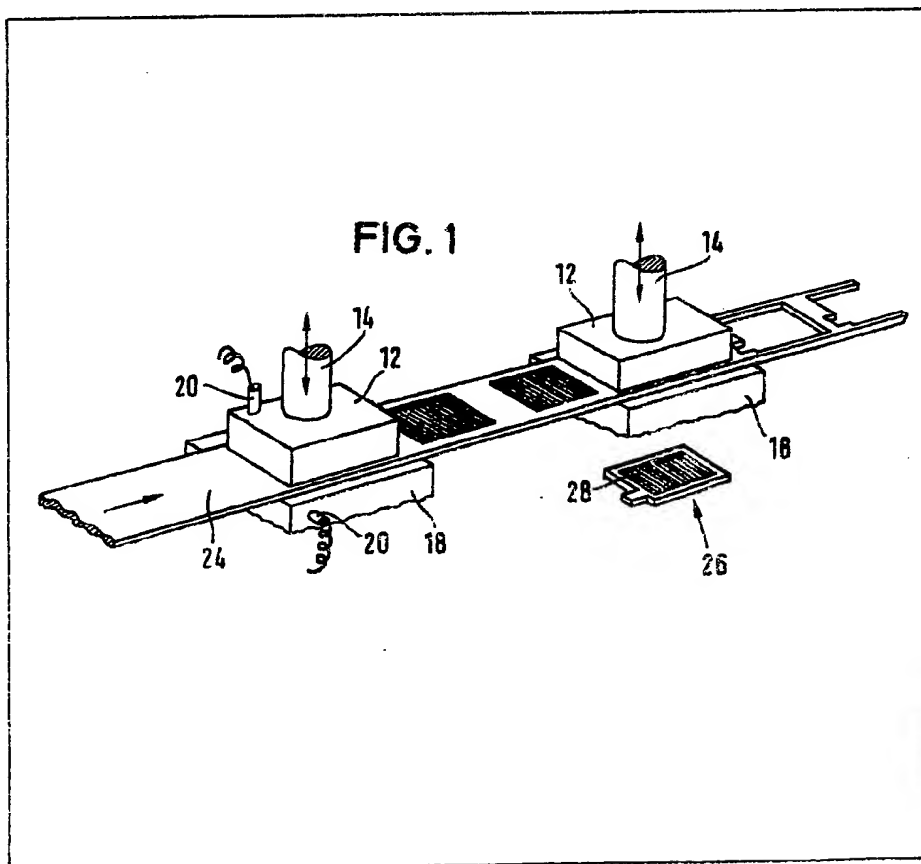
(74) Agents
Keith W Nash & Co
22 Hills Road
Cambridge
CB2 1JP
England

(54) Method of manufacturing
large area accumulator plates and
a tool for performing the method

(57) A method and apparatus for forming accumulator plates is described. Lead strip (24) is fed between a pair of dies having opposed grooved faces which squeeze the strip and deform it to produce a grooved profile (28). The dies are heated so as to raise the temperature of the lead strip to approximately 200°C.

A stamping-out, cutting operation is then performed on the strip to define a plate (26) with a lug and cell connections.

The dies and stamping/cutting-out tool may be mounted between separate pairs of upper and lower press members or may be mounted between a single pair of such members.



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FIG. 1

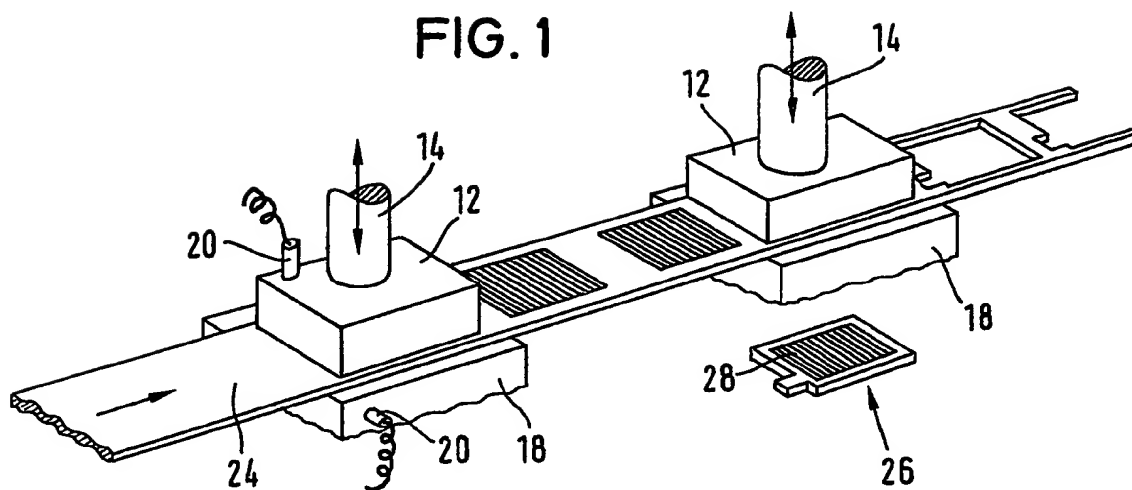


FIG. 2

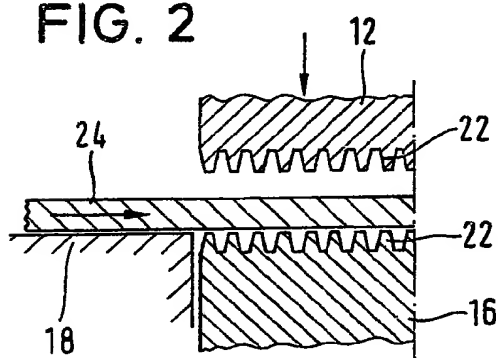


FIG. 3

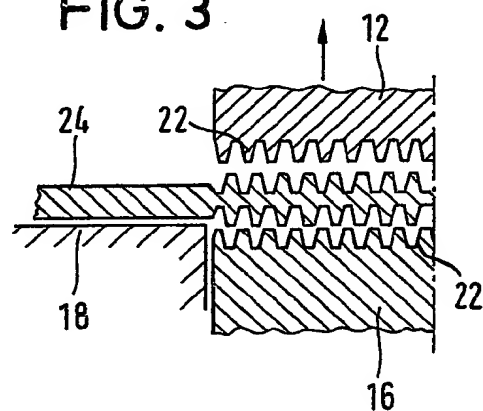
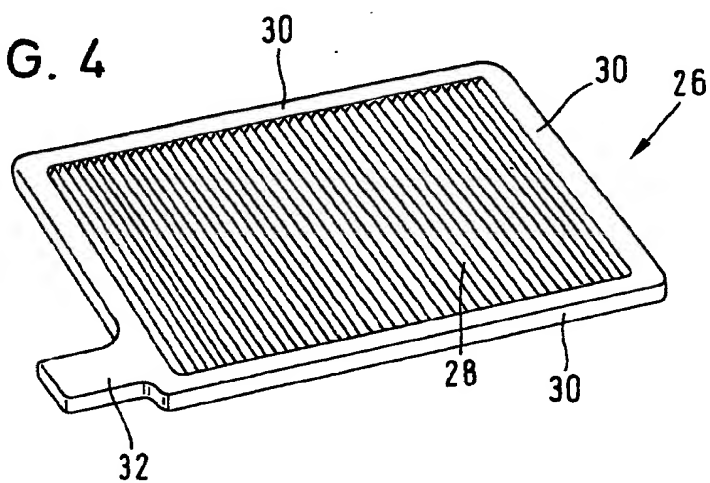


FIG. 4



SPECIFICATION

Method of manufacturing large area accumulator plates and a tool for performing the method

DESCRIPTION

Field of invention

- 10 The invention relates to a method of manufacturing large area accumulator plates. The invention also relates to a tool for performing the method and which has a lower part and an upper part which are movable towards one another, a thermostatically regulated heating device in the lower part and the upper part, and a device for feeding a strip-shaped raw material.

20 *Background to the invention*

- Lead plates having a so-called large area are known in the construction of accumulators. Both sides of these plates have a rib-like profile. The sum of the surface areas on the two flanks of all the ribs, plus the areas of their truncated tips and the areas of the valleys between adjacent ribs, substantially exceeds the sum of the surface areas of a planar front and back. These large surface areas increase the capacity of an accumulator. In accordance with the prior art, accumulator plates having a large surface area are cast. A distinction is made between manual casting and machine casting. In manual casting, molten lead is introduced into a mould by means of a ladle and is solidified in the mould. The mould is subsequently opened, the cast plate is removed and put aside and the mould is closed again. This is an expensive method, and the number of plates which can be manufactured per unit of time is relatively small. The efficiency of manual casting has natural limits. The molten lead introduced into the mould has a specific solidifying time, even if the solidifying time is short owing to the high thermal conductivity of lead.

- Many of the above-mentioned disadvantages of manual casting do not apply to machine casting. However a casting machine is very expensive. The acquisition of a casting machine is only worthwhile for an accumulator factory when the production of large numbers can be guaranteed for long periods of time.

Object of the invention

- Based on these considerations, it is an object of the present invention to provide a method of manufacturing large area accumulator plates mechanically and which can be performed on simple, inexpensive machines and which minimises the disadvantages associated with the processing of lead and to provide apparatus for performing the method.

The invention

- In accordance with the present invention a plane parallel strip of lead is inserted into a press in which it is squeezed from both sides to form a grooved profile and is thereafter stamped out to form a plate.

This method involves impact extrusion of the metal which does not require a press of special construction.

- 75 Hydraulically or pneumatically-operated presses can be used. Alternatively, screw presses or other mechanical presses can be used. Indeed any general purpose press, which may hitherto have been used for other purposes in an accumulator factory, can be used.

- Most presses can be rapidly converted for the purpose of the invention. Thus, the question of costs is resolved in an extremely advantageous manner and compared with the known casting methods, operating costs can be saved since the strip of lead can be employed in the form in which it is supplied, (it being no longer necessary to melt the lead as previously was the case) and this dispenses with the energy costs hitherto incurred.

- Advantageously, the pressing-in of the grooved profile and the stamping operation are performed as two steps. The stamping operation is then a form-cutting operation, and cell connections and lugs can be simultaneously formed when the lead strip is cut up.

- According to a preferred feature of the method, the lead strip is heated during pressing in order to expedite the pressing operation and to reduce the force required. One or both of the pressing members acting on the lead can be heated. Typically the lead strip is heated to approximately 200°C. Owing to the high thermal conductivity of lead, this temperature can be attained almost instantaneously.

- According to a preferred feature of the invention apparatus for performing the method of the invention comprises a pair of grooved dies disposed in upper and lower movable members of a press and a shaping and cutting tool which is situated beyond the dies in the direction in which the lead strip is advanced. The dies and the shaping and cutting tool together form a compound tool.

- 115 It will thus be seen that an existing press can be readily converted to perform the method of the invention by incorporating a compound tool therein. 120 The invention will now be described by way of example with reference to the accompanying drawings.

In the drawings

- 125 *Figure 1* is a perspective simplified diagrammatic illustration of a press-tool constructed in accordance with the invention. *Figure 2* is a cross-section through the upper and lower parts of the press-tool before a pressing operation to produce the grooves,

Figure 3 is a cross-section through the upper and lower parts after the grooves have been pressed, and

- 5 Figure 4 is a perspective illustration of a finished accumulator plate produced by punching/stamping out from the strip.

Detailed description of the drawings

- 10 The press-tool includes two upper parts 12 which are movable up and down by plungers 14. The tool also includes two lower parts 16 which are located in housings 18. Heating current supply leads 20 lead to the left-hand upper part 12 (of Fig. 1) and to the housing 18 located therebelow.

- 15 Figs. 2 and 3 show the grooved surfaces 22 of the upper and lower dies. In the illustrated embodiment, the grooved dies are formed integrally within the upper and lower parts shown on the left in Fig. 1. The upper and lower parts shown on the right of Fig. 1 accommodate a cutting and stamping-tool which is not shown in detail.

- 20 A lead strip 24 is advanced between the upper and lower parts in the direction indicated by the arrow. The accumulator plate 26 having a grooved profile 28, cell connections 30 and a lug 32, is formed from the lead strip during the two-stage process.

- 25 The two upper parts 12 on the stamps 14 are moved up and down, and the lead strip 24 is advanced when the upper parts 12 are raised. Initially the lead strip has plane sides as shown in Fig. 2 but is changed by the dies on the left of Fig. 1 to the cross-section shown in Fig. 3, in which its top side and underside are grooved. The lead strip is subsequently moved until the grooved section lies between the press halves located on the right of Fig. 1 where the cell connections 30 and the lug 32 are formed, and the accumulator plate 26 is simultaneously cut out.

- 30 In contrast to the diagrammatic illustration of Fig. 1, the dies having the grooved surfaces 22, and the shaping and cutting tool, can be fixed to common upper and lower parts.

CLAIMS

- 35 1. Method of manufacturing an accumulator plate in which a plane parallel lead strip is introduced into a press where it is squeezed from both sides to form a grooved profile and is thereafter stamped-out to form the plate.
- 40 2. Method as claimed in claim 1, in that the pressing-in to form the grooved and the stamping-out operation are performed as two separate steps.
- 45 3. Methods as claimed in claim 1 or 2, in which the stamping-out step cuts the plate to shape and forms at least one cell connector and a lug therein.
- 50 4. Method as claimed in any of claims 1 to 3, in which the lead strip is heated during the pressing step.

5. Apparatus for performing the method claimed in any of claims 1 to 4, having upper and lower parts which are movable towards one another, a thermostatically regulated heating device in the upper and lower, or both the said parts, and a device for feeding strip-shaped raw material therebetween, in which the upper and lower parts incorporate grooved dies, and a shaping and cutting tool is disposed beyond the dies in the direction of advance of the strip.

6. Apparatus as claimed in claim 5 in which the grooved dies and the shaping and cutting tool are in the form of a compound tool.

7. Apparatus as claimed in claim 5 in which the dies are mounted between one pair of upper and lower parts and the cutting and shaping tool is located between another pair of upper and lower parts.

8. Apparatus as claimed in claim 5 in which the dies and cutting and shaping tool are mounted between a common pair of upper and lower parts.

9. A method of forming an accumulator plate substantially as herein described with reference to and as illustrated in the accompanying drawings.

10. Apparatus for forming an accumulator plate constructed, arranged and adapted to operate substantially as herein described with reference to and as illustrated in the accompanying drawings.

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